

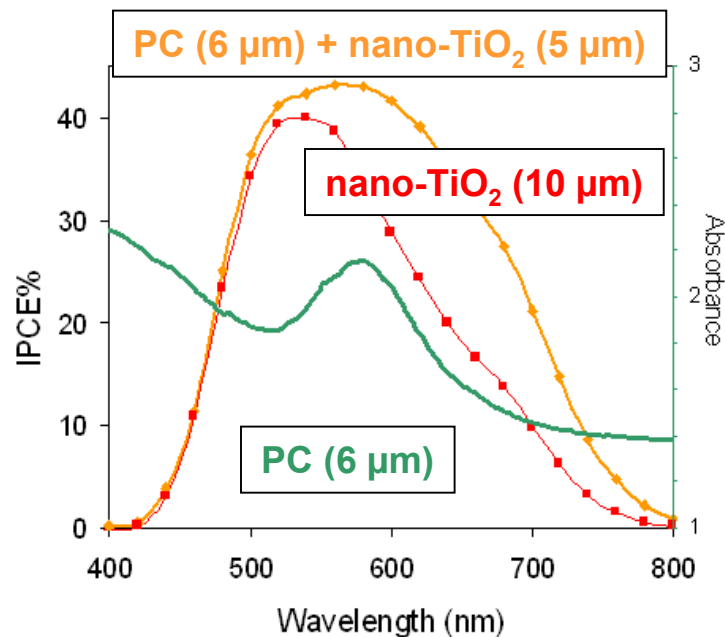
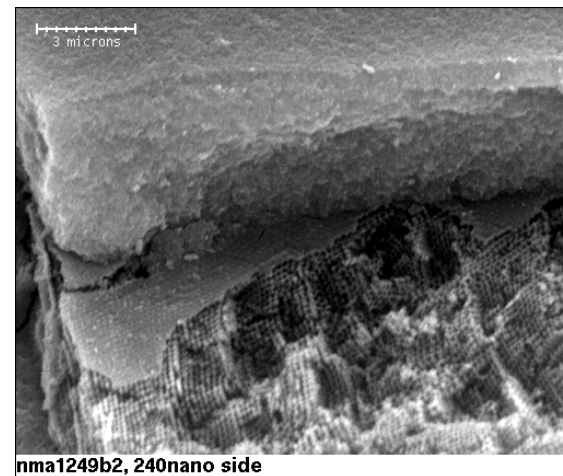
# MRSEC: Center for Nanoscale Science

Moses Chan, Penn State University, DMR-0213623

## Enhancing Solar Energy Conversion in Dye-Sensitized $\text{TiO}_2$ Photonic Crystal Cells

Nanocrystalline dye-sensitized titanium dioxide ( $\text{TiO}_2$ ) solar cells have been studied intensively over the past decade because they are relatively efficient and inexpensive. One of the problems with these cells is their poor response in the red part of the solar spectrum. By designing bilayer electrodes containing nanocrystalline and “opal” structure  $\text{TiO}_2$ , we have shown that the speed of red light can be effectively slowed down to dramatically increase the red response of the cell.<sup>1</sup> By playing similar tricks with the flow of light in porous materials we hope to increase the efficiency of several different kinds of solar cells without significantly changing the chemical makeup of the materials from which they are made.

1. Nishimura, et al., *J. Am. Chem. Soc.* 2003, 125, 6306



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**Outreach:** In collaboration with the science museum The Franklin Institute (Philadelphia, PA) we have produced a 60-minute cart-based interactive exploration titled *Materials Matter: It's a Nanoworld After All*. The show, which includes demonstrations and macro-scale models, explores the "micro" mechanisms behind the unusual and surprising "macro" behavior of materials such as aerogels, shape-memory alloys, polymers, electronic ink, and zeolites. In 2002, the show was distributed to 22 (roughly equal numbers of small, medium and large) science museums nationwide. A representative from each of the museums traveled to Philadelphia, was provided training, and provided demonstrational materials and supplies to equip a show for 1 to 1½ years at their home museum.

**Broader Impact:** In addition to an estimated 2 million school-aged museum visitors viewing the show in 2003, the show is used locally by faculty and graduate students to present at events such as classroom visits, community outreach events, visiting K-12 groups, summer camps and workshops for girls and ethnic groups which are under-represented in engineering and science.



MRSEC graduate student Ben Hutchins demonstrates how electronic ink works using an egg tray and ping pong balls.